

SEALED PLUG CONNECTION THROUGH A PARTITION WALL AND METHOD OF FITTING

The present invention relates to a plug connection for producing at least one electrical connection through an opening in a partition wall. The plug connection, which is also known
5 as a through plug, comprises a first and a second plug, which can be plugged together, and at least one of the plugs can be sealed from the partition wall by means of a seal that surrounds the opening. The invention relates, in particular, to a plug connection, at least one of the plugs of said connection comprising a clamping device which can be engaged with the other plug and enables the two plugs to be clamped permanently in the direction in which they are
10 plugged together, with interposition of the partition wall. The invention also relates to a method of fitting for producing an electrical plug connection of this type.

With a known generic plug of the type shown, for example, in the published international patent application WO 2004/047234 A1, the two plugs are clamped to one another with interposition of the partition wall by means of a sliding device which is
15 displaceable for clamping the two plugs in a direction substantially transverse to the direction of passage through the partition wall. Guide rails convert the pushing force into a clamping force.

However, this known clamping device is accompanied by the problem that moisture can penetrate at the joints between the clamping device and the plugs and lead to failure of
20 the plug connection.

It is accordingly the object of the invention to improve a generic plug connection and a method of fitting of the aforementioned type in such a way that the seal from the environment and the security of the connection can be increased.

According to the present invention, this object is achieved by a plug connection having the features of claim 1. The object is also achieved by a corresponding method of fitting comprising the steps of the independent method claim.

A further object of the invention is to improve a generic plug connection and a
5 method of fitting of the aforementioned type in such a way that at least one of the two plugs can be fixed as easily as possible on the partition wall and fitting errors can easily be detected.

This object is achieved by a plug connection having the features of claim 27 and by a corresponding method of fitting having the steps of claim 33.

10 A plurality of subclaims relate to advantageous developments of the present invention.

The present invention is based on the fundamental idea that the undesirable penetration of moisture into the interior of the plug can be avoided if the connection region between the clamping device and the at least one plug is sealed by a sealing device.

15 According to an advantageous embodiment, the clamping device comprises at least one actuating projection which co-operates with a socket arranged on one of the plugs, to clamp the plug. The force applied during clamping can easily be converted into a clamping force in this way.

In order to minimise the region which a sealing device of this type has to seal, the
20 clamping device in an advantageous embodiment can comprise a locking lever which, for clamping the two plugs, is pivotal about an axis of rotation extending substantially transversely to the passage direction through the partition wall. With an arrangement of this type, it is merely necessary to seal the region in which the locking lever is rotatably mounted.

In order to achieve particularly effective conversion of power from a pivoting movement into a clamping force for clamping the two plugs, at least one tooth with involute tooth faces can be arranged on each of the bearing projections as the actuating projection.

According to an advantageous embodiment, the clamping device comprises a locking lever with a base region and two leg regions. Bearing projections which are rotatably connected in corresponding bearing recesses in one plug are formed on the leg regions. In this way, the locking lever can be made, in a particularly simple manner, to be pivotal about an axis of rotation extending substantially transversely to the passage direction through the partition wall, in order to clamp the plugs. The sealing device can then be arranged on the bearing projections, for example in the form of an O-ring, or, alternatively, is sprayed directly onto the bearing projections.

A particularly inexpensive, simple embodiment of the sealing device according to the invention is achieved if the sealing device is formed by a resilient O-ring.

The seal from the partition wall has to be arranged peripherally around the opening in the partition wall. According to an advantageous embodiment, the seal can be sprayed onto the outer periphery of the plug, so the seal is arranged captively on the plug housing. In addition, the connection between the seal and the plug, on which it is sprayed, is always completely tight. However, this seal can also be a separate part which can be brought into contact with both the plug and the partition wall.

To prevent unintentional release of the clamping device, a separate securing device, which is also described as the connector position assurance (CPA), can be provided to arrest the clamping device in a finally fitted state.

The securing device is releasable in a particularly compact manner if it is displaceable in a direction transverse to the passage direction through the partition wall.

A catch lug, which is provided for latching the clamping device on the securing device, represents a particularly effective, easily produced locking means.

A correspondingly sealed sliding clamping device can also be used as an alternative to the pivotal locking lever, and this is beneficial, for example, if the available space does not
5 allow pivoting of the locking lever during fitting. The clamping device can be a sliding device comprising at least one step-up or step-down arrangement. This allows an applied sliding force or movement to be transformed into a greater or smaller clamping force or movement.

It is particularly advantageous if the clamping device is a sliding device which is
10 displaceable in a direction substantially transverse to the passage direction through the partition wall, in order to clamp the plug. This results in a particularly simple clamping device on the plug connection, the clamping can be carried out very quickly and easily and the necessary space can be minimised.

In a further advantageous embodiment of the invention, the clamping device can
15 comprise at least one guide rail which extends in part in a plane longitudinally to the plugging-together direction and substantially transversely to the plugging-together direction. This enables a sliding force or movement to be transformed into a clamping force or movement.

If a sealing device is provided on an opening of a first plug housing, through which an
20 engagement element of the clamping device dips, then a clamping device configured as a sliding device can be particularly effectively sealed from penetrating moisture. A seal of this type can be sprayed on, for example, and can also have complicated cross sections, for example with at least one sealing lip, to improve the tightness.

A particularly reliable seal, which can be produced with minimal force, can be achieved if at least one sealing projection, which cooperates with the sealing device to seal the plug connection, is formed on a second plug housing.

Since a locking device is additionally provided, which is movable between a locked position, in which the second plug is fixed on the partition wall, and an unlocked position, particularly secure fixing of the second plug on the partition wall can be achieved. A locking device of this type, which can also be described as further connector position assurance (CPA), can be constructed in such a way that unlocking is also possible and the second plug can easily be removed from the partition wall in the event of a repair. On the other hand, if relatively great forces have to be applied when plugging in the first plug, it is possible to ensure that the second plug is not unintentionally released from the partition wall. In particular, if this second plug is held in a vehicle body panel, of which the back is not readily accessible at the moment of plugging together, as is the case, for example, with a car door, the solution according to the invention avoids the situation where the second plug can no longer be correctly contacted. Since the locking device is mechanically fixed in the unlocked position, a defined position of the locking device can be ensured in the pre-fitted state.

At least one catching device can also be arranged on the locking device in order to secure the locking device in cooperation with an associated latching opening in the locked position. This is particularly important in applications in the automotive industry, in which pronounced mechanical and thermal stresses occur during operation.

To prevent the locking device from unintentionally moving from the unlocked position, the at least one catching device can cooperate, in the unlocked position, with a further associated catching opening, in order also to fix the locking device in this position.

This catching connection is expediently accessible from the exterior (at least to a suitable tool), so that it is releasable, should removal be desired.

In the simplest case, the locking device can be displaceable relative to the second plug in the direction in which the two plugs are plugged together. However, this solution has the
5 drawback that it cannot be ensured that the two plugs are plugged in only when the locking device is correctly located in its locked position. In order to ensure, in a particularly simple manner, that the two plugs can be plugged in only if the second plug is located in its final position in the opening in the partition wall and the locking device is correctly locked, the locking device can be mounted on the second plug housing by means of a hinge-like
10 connection and be movable between the locked and the unlocked position by a pivoting movement about an axis extending substantially transversely to the passage direction through the partition wall.

In an embodiment of this type, for example, an edge region remote from the axis of rotation can then be arranged in the second plug housing in such a way that the two plugs
15 cannot be plugged together in the unlocked state.

The locking device proposed in conjunction with the present clamping device can obviously also be used for other plug connections.

The invention is described in more detail hereinafter with reference to the embodiments illustrated in the accompanying drawings. Like or corresponding parts of the
20 plug connection according to the invention are provided with like reference numerals in the figures, in which:

Fig. 1 is a perspective, partially open view of a plug connector according to a first embodiment fitted in an opening in a partition wall;

Fig. 2 is a perspective view of the plug connection according to the invention rotated relative to the view in Fig. 1;

Fig. 3 is a perspective view of the plug connection according to the first embodiment, in which one of the two plugs is held in the opening in the partition wall and the other plug is positioned in readiness for fitting prior to plugging together;

Fig. 4 is a perspective, partially exploded view of the first plug according to the first embodiment;

Fig. 5 is a perspective, partially exploded view of the second plug according to the first embodiment;

Fig. 6 is a perspective view of the second plug held in the partition wall according to the first embodiment;

Fig. 7 is a perspective, partially exploded view of a first plug according to a second embodiment;

Fig. 8 is a perspective, partially exploded view of a second plug according to a second embodiment;

Fig. 9 is a perspective view of the first plug from Fig. 7 in readiness for fitting;

Fig. 10 is a perspective view of the second plug according to the second embodiment held in the partition wall;

Fig. 11 is a perspective, partially open view of the plug connector according to the second embodiment fitted in the opening in a partition wall;

Fig. 12 is a partially sectional view of the second plug according to a further advantageous embodiment during fitting in the partition wall;

Fig. 13 is a partially sectional view of the second plug according to Fig. 12 after fitting in the partition wall;

Fig. 14 is a perspective view of the second plug from Fig. 12;

Fig. 15 is a perspective, "detailed view of the second plug according to Fig. 12, the locking device being shown in the pre-fitted state;

Fig. 16 is a perspective, partially open detailed view of the second plug according to
5 Fig. 12, the locking device being in the locked state;

Fig. 17 is a perspective view of a plug connector fitted in the opening in a partition wall according to a further advantageous embodiment;

Fig. 18 is a perspective view of the second plug from Fig. 17;

Fig. 19 is a perspective view of the plug connector from Fig. 17 before the first and
10 second plug are plugged together;

Fig. 20 is a perspective, partially exploded view of the first plug from Fig. 17;

Fig. 21 is a perspective view of the first plug from Fig. 19 in readiness for fitting;

Fig. 22 is a perspective view of a single-part embodiment of the seals from Fig. 21;

Fig. 23 is a perspective view of the second plug according to Fig. 19, held in the
15 partition wall, with seals;

Fig. 24 is a perspective, partially open view of the second plug according to Fig. 19 with an unlocked locking device;

Fig. 25 shows a detail D from Fig. 24;

Fig. 26 is a perspective, partially exploded view of the second plug from Fig. 19.

20 In a first embodiment shown in Fig. 1, the plug connection 100 according to the invention comprises a first plug 1 and a second plug 17. The second plug 17 is fitted in a partition wall 37. According to the present embodiment, the second plug 17 is a pin-type plug and the first plug 1 is the associated socket plug, though this is not essential to the present invention as the arrangement of pins and sockets could also be reversed.

According to the invention, the first plug 1 is sealed from the partition wall 37 by means of a peripheral seal 28. As will be described hereinafter with reference to Fig. 3 and 4, the plug connector 100 according to the invention comprises a clamping device 160 which, in the finally fitted position shown in Fig. 1, clamps the two plugs together with interposition of the partition wall 37. According to a first embodiment, a locking lever 160 acts as the clamping device. The first plug 1 comprises a first plug housing 2, a connecting piece 7, to which a bush can be attached, a first pin recess 5 and a second pin recess 6. The bush, which is not shown here, and the connecting piece 7 form part of a channel through which a cable (not shown) can be introduced into the interior of the first plug housing 2.

To prevent the penetration of moisture into the interior of the plug at the connection point between the first plug housing 2 and the locking lever 160, the first plug 1, according to the invention, has a sealing device 162. In the embodiment illustrated, this sealing device is embodied by a simple O-ring. However, other methods of producing the sealing device can obviously also be employed such as, for example, spray-on seals or seals of complex shape comprising, for example, sealing lips.

As will be illustrated in Fig. 3, the seal is arranged on a bearing projection 164 which holds the locking lever 160 pivotally in the direction 166 in a bearing recess 168 of the first plug housing 2. Owing to the specific configuration of the sealing device 162 as an O-ring, the seal can be ensured in a particularly simple manner despite the movability of the locking lever 160.

To illustrate the construction of the locking lever 160, the plug connection 100 according to the invention is shown again in a rotated perspective view in Fig. 2. This view shows that the locking lever 160 is protected from unintentional unlocking in the direction 166 by a securing device 170. The securing device 170 comprises a catch lug 172 for latching

with the catch opening 174 of the locking lever 160. With this arrangement, the locking lever 160 can be prevented from pivoting unintentionally so that the sealing clamp between the two plugs 1 and 17 is unintentionally released, on the one hand, whereas the catching device 172 is easily accessible from the exterior so that it can be opened if necessary (at least with a suitable tool), on the other hand.

Fig. 3 shows the first embodiment of the plug connection according to the invention in the unfitted state. The second plug 17 is already fitted in the partition wall 37. A resilient spring arm 152 with a catch lug 131, which are formed on the housing 25, secure the second plug 17 in the opening in the partition wall 37. Space can additionally be saved during fitting as the second plug 17 does not yet have to rest securely on the partition wall 37 in this "parking position" but, if necessary, is still displaceably mounted. The second plug 17 is not drawn toward the partition wall 37 and pressed thereon until the contact with the first plug 1 is closed and the contact is tightened by means of the locking lever 160. The recess 176 allows the engagement of an actuating projection 178 formed on the locking lever for clamping the two plugs against the partition wall 37 (see Fig. 4). With regard to its operating principle, the engagement element 176 is configured as a reduced rack, which cooperates with the actuating element 178 configured as part of a gear-wheel.

To prevent the second plug 17 from falling out of the partition wall when mechanically stressed during fitting, a locking device 102 is further provided, which operates by blocking inward deflection of the catch arm 152 in the locked state so that the plug 17 can no longer fall out of the opening. In the illustrated embodiment, the resilient catch arm 152 is formed integrally on the plastic housing of the second plug.

As will be illustrated in Fig. 5, the locking device 102 comprises a catch lug 110 which, in both the locked and the unlocked state, latches in a corresponding catch opening

124 and 126 so that the locking device 102 is captively secured in both positions. The locking device 102 is movable between the locked position and the unlocked position in the direction 150, i.e. in the direction in which the two plugs 1 and 17 are plugged together. This is advantageous, in particular, because the locking device can therefore be accessed particularly easily from the exterior and can easily be locked and also released again by a user. Two elongated cut outs 154 also allow flexible movability of the catch lug 110. An actuating projection 156 simplifies operation of the locking device 102 by a user. The faces 158 (see Fig. 5) have the function of blocking the catch hooks 131 in the locked state.

A drip proof cap 26 covers the second plug 17 and thus protects it from the penetration of drips.

The first plug 1 is shown here with the locking lever 160 pivoted upwards. The securing device 170, which is displaceably mounted on the housing 2, is located, in the illustrated view, in a position in which latching with the catch lug 172 is permitted during subsequent pivoting of the locking lever 160. Once the locking lever 160 has pivoted about the indicated axis of rotation 180, the securing device 170 can be pushed in the direction 182 so that the catch lug 172 engages with the projection 184 on the locking lever 160 and holds it securely in its locked position. An actuating projection 186 simplifies the displacement of the securing device 170. To ensure secure guidance, the securing device is also displaceably held in corresponding grooves on the housing 2. Finally, a securing tab is formed on the securing device 170 to prevent displacement of the securing device in the direction 182 until it is pressed against the housing 2 by the folded down locking lever 160 and allows the securing tab 188 to be displaceable into the groove 190.

Fig. 4 shows the first embodiment of the first plug 1 in an exploded view. Referring to Fig. 4, the first and second pin recesses 5, 6 are configured to be complementary to one

another in certain regions so that the first pin recess 5 can be inserted into the second pin recess 6 in the direction of the arrow 8 in certain regions. In the plugged together state, the first and second pin recesses 5, 6 can be introduced into the interior of the first plug housing 2 in the direction of the arrow 9. A catch device 192 ensures that they are held securely in the first plug housing 2. In accordance with the invention, the first plug housing comprises substantially circular bearing recesses 168 through which the bearing projections 164 dip and allow rotatability about the axis 180 which is indicated in a broken line.

According to the invention, an O-ring 162 is pushed over the respective bearing projections 164 as a sealing device. This O-ring prevents the penetration of moisture through the bearing opening 168 into the interior of the plug housing 2. The plug housing is sealed from the partition wall in the fitted state via the seal 28. This seal can either be sprayed on or be produced as a prefabricated part made, for example, of silicone rubber, and fitted on the plug housing 2. The locking lever 160 has a substantially U-shaped configuration with two legs, on which the bearing projections 164 are formed, and a base which engages with the securing device 170. The fact that the locking lever 160 partially surrounds the housing 2 allows an arrangement which is as compact as possible to be produced.

A part of a gear-wheel which engages with corresponding engagement elements 176 on the second plug housing 25 is constructed on the bearing projection 164 as the respective actuating element 178. Advantageously, the actuating element 178 is configured as a portion of involute gear teeth and the tooth face 194, which has to withstand all the force in the finally fitted state, is formed on the solid material of the bearing projection 164 to allow better absorption of force and long-term stability.

The second plug 17 of the plug connector according to invention, according to the first embodiment, is shown in a partially exploded view in Fig. 5. The second plug 17 has a second plug housing 25, a drip proof cap 26 and a locking device 102.

The drip proof cap 26 can be slid onto the second plug housing 25 in the direction of the arrow 29. An outer periphery 30 of the second plug housing 25 engages with an encompassing rim 31 of the drip proof cap 26.

Once fitted, the drip proof cap is secured on the plug housing 25 by a catch 196.

Referring to Fig. 5, the locking device 102 comprises an actuating projection 156 which simplifies operation of the locking device by the user. In the locked state, the faces 158 have the function of blocking the catch hooks 131.

Fig. 6 finally shows the second plug 17 again in the position held in the partition wall 37 in readiness for plugging.

Operation of the first embodiment of the plug connection of the associated method of fitting, shown in Fig. 1 to 6, will be described hereinafter.

The first plug 1 is initially pre-fitted. Referring to Fig. 4, the first pin recess 5 is introduced into the second pin recess 6 in certain portions in the direction of the arrow 8. In this state, the first and second pin recesses 6, 5 are inserted into the interior of the first plug housing 2 in the direction of the arrow 9. A bush (not shown here) can then be pushed over the connecting piece 7 in certain regions. In addition, pins are fitted in the first and second pin recesses and a supply cable is laid through the interior of the bush into the interior of the first plug housing 2, and strands of the connecting cable are connected to corresponding pins, in order to fit the first plug 1.

The second plug 17 is fitted independently of this. In particular, the drip proof cap 26 is pushed onto the second plug housing 25 in the direction of the arrow 29. Pins are also inserted into the second plug 17 and one or more supply lines are laid.

A connection can now be produced through the opening 39 in the partition wall 37 using the plug connection according to the invention. The connection is an electrical connection in this embodiment.

Referring to Fig. 5 and 6, the second plug 17 is guided through the opening 39 in the partition wall 37 in the direction of the arrow 38. Guidance continues until the catch projections 131 are secured on the partition wall. The locking device 102 is subsequently introduced into the housing 25 in the direction 103 and pushed down until it latches in the catch opening 124 and is thus secured against bending inwards by the faces 158 of the catch arm 152, so the second plug 17 is now secured captively in the partition wall.

The second plug 17 is now secured in its position relative to the position wall 37. In car production, this can be a pre-fitted state.

The first and second plugs 1, 17 can now be plugged together. Starting from the position of the first and second plugs 1, 17 shown in Fig. 3, the first plug 1 is guided onto the second plug 17 in the direction of the arrow 150 and plugged together with the second plug 17.

A force is then applied to the actuating face 11 of the locking lever 116 so that the locking lever 116 is pivoted about the axis 180 and the force exerted is converted into a clamping movement by means of the gear-wheel/rack arrangement 178, 176. Tension is thus built up until the actuating element 178 reaches its end position in the engagement element 176. The catch hook 172 also engages with the catch opening 174. In the next step, the securing device 170 is displaced in the direction 182 (see Fig. 3), so that the catch hook 172

is secured on the projection 184 and the clamping device is held against unintentional movement from the end position now adopted. Owing to the mechanical stress, the seal 28 is pressed against the partition wall 37 so that, together with the seal of the locking lever 160, the first plug 1 is reliably protected from penetrating moisture in this position.

5 A second advantageous embodiment of the plug connection according to the invention will now be described with reference to Fig. 7 to 16.

Referring to Fig. 7, the first plug 1 according to a second embodiment comprises a sliding device 704, instead of the clamping device configured as a locking lever, for clamping the two plugs together. The sliding device 704 is accommodated displaceably in the first plug
10 housing 2 in the direction of the arrow 10. The sliding device 704 comprises an actuating surface 11, to which a displacement force can be applied for displacing the sliding device.

The sliding device 704 comprises side elements 12, 13. As shown in Fig. 7, respective upper guide rails 14 and lower guide rails 15 are provided in the side elements 12, 13. The guide rails 14, 15 are guide recesses in this embodiment of the invention.

15 In Fig. 7, moreover, a proposed direction for plugging together the first plug 2 and the second plug 17 is indicated by an arrow 16. The direction 10, in which the sliding device 704 can be displaced in the first plug housing 2, extends substantially transversely to the direction 16 for plugging together the first plug 1 and the second plug 17. The guide rails 14, 15 have step-down portions 18, 19 which extend in a direction substantially transverse to the
20 plugging-together direction 16 and substantially transverse to the sliding direction 10. The guide rails 14, 15 also comprise end portions 20, 21 which extend parallel to the sliding direction 10.

Referring to Fig. 8, the guide rails 14, 15 cooperate with associated pin-like projections 33, 34 for clamping the two plugs together and against the partition wall.

In accordance with the invention and in correspondence with the pin-like projections 33, 34, openings 72, 73, through which the pin-like projections 33, 34 dip so as to cooperate with the sliding device 704, are provided with peripheral seals 163 in order to seal this connection region and prevent the penetration of moisture into the interior of the plug.

5 A peripheral seal 28 is also attached to the first plug housing 2. In the embodiment of the present invention shown in Fig. 7, the seal 28 is sprayed onto the housing 2. The seal 28 is therefore secured captively on the first plug housing 2, and the connection between the seal 28 and the first plug housing 2 is invariably tight. However, the seal 28 can also be a separate part from the first plug housing 2.

10 The foregoing similarly applies to the seals 163 which are also sprayed on the first plug housing in the illustrated embodiment.

In Fig. 8, the second plug 17 according to the second embodiment is shown in a partially exploded view. The elements which correspond to those in the first embodiment will not be mentioned again separately hereinafter.

15 In accordance with the invention, the second plug 17 in the second embodiment comprises pin-like projections 33, 34 which are constructed integrally on the plug housing 25. The pin-like projections 33, 34 are configured in such a way that they can engage with the guide rails 14, 15 of the sliding device 704 of the first plug and thus represent engagement means for the sliding device 704 which acts as a clamping device.

20 Sealing projections 198, which can form a tight joint with the seals 163, are also formed on the second plug housing 25 to seal the openings 72, 73 by means of the seals 163.

A resilient spring arm 152 with a holding device 131 has the function of fastening the second plug 17 in the opening in the partition wall 37, as will become apparent with reference to Fig. 10. A locking device 102 allows blocking of this resilient spring arm 152 in order to

lock the second plug 17 in the partition wall by preventing inward bending of the spring arm 152 in the locked state.

As will become more apparent from Fig. 15 and 16, the locking device 102 according to this second embodiment has bearing projections 206 which are held in corresponding bearing recesses 208 on the second plug housing 25. The locking device 102 can therefore be
5 moved about an axis of rotation 202 between a locked position and an unlocked position. In the unlocked position, the locking device 102 is secured in the catch recess 210 and, in the locked position, in the catch recess 212.

Fig. 9 is a perspective view of the first plug 1 in readiness for plugging.

10 Fig. 10 shows the second plug 17 in readiness for plugging, the locking device 102 being located in the locked position so that the second plug 17 is held securely in the partition wall 37. In this position, the edge 204 of the locking device 102 also makes contact with the plug housing 25 so that the pin trough is vacated and the two plugs can therefore be plugged together.

15 Fig. 11 shows a perspective, partially sectional view of the plug connection according to the invention, according to the second embodiment, in the finally fitted, plugged together state. According to the invention, the sealing devices 28 and 163 ensure that the internal electrical connections are completely sealed against the penetration of moisture. The two plugs 1 and 17 are firmly clamped with the partition wall 37.

20 The fitting of the second plug 17 in the partition wall 37 according to the second embodiment will be described in greater detail hereinafter with reference to Fig. 12 and 13. In contrast to the previous embodiments, a seal 27 similar to the seal 28 is provided on the second plug 17 for providing a seal from the partition wall 37. It is however clear to a person

skilled in the art that the side of the partition wall 37 on which a seal is provided is immaterial to the principles according to the invention.

The locking device 102 is in the unlocked position, as shown in the partially open view in Fig. 12. For fitting, the second plug 17 is inserted obliquely into the opening in the partition wall 37, the proposed free distance 134 ensuring that the necessary tilting about the angle α is possible.

After insertion, the second plug 17 is pivoted about the lower edge in the direction 112 so that the projection 131 also holds the second plug 17 in the partition wall 37. The locking device 102 can now be tilted in the direction 113, so that, on the one hand, inward pressing of the catch hook 131 is prevented and, on the other hand, the projections 214, 216, which are shown more clearly in Fig. 15 and 16, cooperate with the partition wall 37 so as to hold the second plug 17 in the opening in the partition wall 37.

In the illustrated embodiment, the plug 17 is also still displaceable by the distance 137 transversely to the plugging-together direction in the pre-fitted position shown in Fig. 13. In the position of the locking device 102 shown in Fig. 13, the pin trough 128 is vacated so plugging together can now take place.

The fitting step shown in Fig. 12. is shown again in a perspective view in Fig. 14. It is apparent that the locking device 102, which is latched in the unlocked position in this drawing, blocks the pin trough 128 with its edge 204. This ensures that the second plug 17 and the first plug 1 can only be plugged together in the completely locked state. Fitting errors can thus be detected promptly and eliminated.

Fig. 15 and 16 show two detailed views of the second plug, illustrating the mode of operation of the locking device 102 more clearly. Fig. 15 shows the unlocked state, in which the locking device 102 is latched in the catch recess 210 in such a way that the pin trough 128

for plugging the two plugs together is blocked. As will become apparent from comparison with Fig. 8, the locking device is held in the bearing recesses 208 by means of the bearing projections 206 in such a way that it is pivotal in the direction 113. In the locked position shown in Fig. 16, on the one hand, the movement of the catch hook 131 is blocked and, in addition, the projections 214, 216 dipping through the second plug housing secure the second plug 17 directly in the partition wall 37. The plug 17 is held in the partition wall 37 on the opposite face of the housing 25 by the fixed holding projection 132.

Fig. 17 is a perspective view of a further advantageous embodiment of the plug connection according to the invention. As in the second embodiment, a sliding device 704 for clamping the two plugs 1, 2 together is also provided here. In order to be able to release the sliding device 704 again without difficulty, if necessary, a recess 218 that allows a user to grasp the sliding device 704 securely is provided on either side of the first plug housing 2. Catch recesses 220 and 224 with associated catch hooks 226 (see also Fig. 20) secure the sliding device 704 on the first plug housing 2. In particular, the catch hook 226 engages in the catch recess 220 in the finally fitted state and is secured by the catch recess 224 in the pre-fitted state.

In addition to the peripheral catch projection 228 shown in conjunction with the second embodiment, the connecting piece 7 has a resilient catch arm 230 in the embodiment shown here. Both the peripheral projection 228 and the catch arm 230 allow the mechanical fixing of a bush, not shown in detail here.

Fig. 18 is a perspective view of the second plug 17 in Fig. 17. The second plug 17 is positioned in the partition wall 37, but is not yet finally fixed. The locking device 102 is still in the pre-catching position. According to the present embodiment, locking in the partition wall 37 is achieved here solely via the resilient spring arm 152 and the holding structure 131

formed thereon and via the opposing holding structure 132. As will become apparent in the following Fig. 19, the locking device 102 holds the spring arm 152 in the locked position in the finally latched state.

Fig. 19 shows the plug connection 100 from Fig. 17 before the first and second plug 1, 17 are plugged together. The second plug 17 is held firmly in the partition wall 37 in this phase, and the locking device 102 holds the spring arm 152 in the position shown. The first plug 1 is located in a position in readiness for plugging, in which the sliding device 704 is latched by means of the catch openings 224 in a pre-fitted state.

Fig. 20 shows the first plug 1 in the embodiment shown in Fig. 17 in a view similar to Fig. 7. The explanations given with respect to the second embodiment basically also apply accordingly to the embodiment shown in Fig. 20. In particular, the openings 72 and 73 provided with peripheral seals 163 and the functionality of the sliding device 704 correspond to those of the second embodiment. As already mentioned, in the present embodiment, the sliding device 704 has catch hooks 226 so that it can be held securely in the first plug housing 2 in both a pre-catch position and the finally fitted position. The first pin recess 5 and the second pin recess 6 have a somewhat modified form. However, this configuration should be taken only as an example, as the principles according to the invention can advantageously be employed with any plug shapes. Owing to the recesses 218, the actuating face 11 of the sliding device 704 can extend rectilinearly in the third embodiment, and this reduces the space required.

Fig. 21 is a perspective view of the first plug 1 according to the embodiment shown in Fig. 20, in readiness for plugging.

Fig. 22 shows the peripheral seal 28 for sealing from the partition wall 37 and the sealing devices 163 released from the plug connection. According to the present

advantageous embodiment, the four sealing devices 163 are produced integrally with the seal 28 in that they are connected to the seal 28 via webs 199. This configuration has the advantage of simplified production in one operation both as a separately laid in sealing arrangement and as a seal which is sprayed onto the plug 1. In the latter case, it is not
5 necessary to provide undesirable injection points on the fine structures of the sealing devices 163. In addition, this embodiment allows a reliable seal in the region of the projections 33, 34.

Fig. 23 shows the second plug 17 according to the embodiment from Fig. 19 in readiness for plugging, the second plug 17 being fitted in the partition wall 37 and the seals
10 28 and 163 from Fig. 21 also being shown to illustrate the position thereof. In this embodiment, the seal 28 and the sealing devices 163 are in turn constructed in one piece in that the webs 199 produce a joint.

Fig. 24 and 25 show the configuration of the locking device 102 in the embodiment shown in Fig. 18 and in the unlocked position in detail. The functionality of the locking
15 device 102 basically corresponds to the principles described with reference to Fig. 15 and 16.

Fig. 26 shows the second plug 17 from Fig. 19 in a partially exploded view. In comparison with the similar embodiment shown in Fig. 8, the simplified configuration of the pivotal locking device 102 is of particular importance in this embodiment. The locking device 102 is configured without the projections 214, 216 dipping through the second plug housing.
20 Regardless of this, however, any functional mechanisms described with respect to the foregoing configurations can also be transferred to the present embodiment.

With the aid of the plug connection according to the invention, on the one hand, the tightness cannot be influenced by the pull of the cable and, on the other hand, an optimum sealing function relative to a partition wall, for example a vehicle body panel, is ensured

owing to the axial seal at the socket plug. The pin trough is protected from dripping water, and fitting as well as removal are simple and clear. Closure of the coupling produces a defined sealing fit between plug and partition wall in addition to the electrical contact. Finally, the Kojiri security can be ensured by a deep trough and a high protective web.